INVESTIGATION OF URINARY TRACT INFECTION IN A GROUP OF PREGNANT WOMEN

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Urinary tract infection is a common disease and afflicts women more frequently than men. Recent surveys of defined populations in Wales and Jamaica revealed an incidence of significant bacteriuria of 4 per cent in women and 0·5 per cent in men (Kass, 1965). In pregnancy women are at higher risk and about 6 per cent have been found to have asymptomatic bacteriuria (Kass, 1960; Turner, 1961; Kincaird-Smith, 1965 and Little, 1966). Since chronic pylonephritis is an important cause of renal failure the early detection and adequate treatment of acute pyelonephritis may prevent chronic renal disease in later life. Evidence of active pyelonephritis has been found in 10 to 20 per cent of autopsies of patients in several hospital series (Jackson et al 1955; Kass, 1967) but in only 20 to 30 per cent of these was the diagnosis made during life. The majority of urinary tract infections were therefore undiagnosed.

A definite diagnosis of urinary tract infection can be difficult. Some patients with the infection are asymptomatic. In others who have symptoms of the disease the identification of the causative organism has been difficult when reliance was placed on the usual methods of microscopic evidence of pyuria and bacteriological culture.

The following is an account of how this difficulty can be overcome by using the method of quantitative bacterial culture. The other object was to identify the common organisms responsible for urinary tract infection among a group of pregnant women in Singapore.

MATERIALS AND METHOD

This report was of pregnant women who attended the Kandang Kerbau Maternity Hospital Singapore from April to December 1966. All who had urinary symptoms (*e.g.* increased frequency of micturition, dysuria, or loin ache) or had evidence of proteinuria were included in the study. Each of these patients was asked to collect a fresh mid-stream specimen of urine into a sterile wide-mouthed Heinz baby food bottle. No prior cleaning of the vulval area was done. Quantitative bacterial culture was performed on each specimen within 30 minutes of collection. The following technique was employed.

Under sterile conditions the urine was serially diluted with sterile water so as to give final concentrations of urine of 10^{-1}, 10^{-2}, 10^{-3} and 10^{-4}. A pipette which delivers a drop size of 0·02 ml. was used. Calibration experiments showed an average drop to contain 0·0185 ml. and the maximum error at 95% point *i.e.* standdard deviations was 0·0195 ml. Holding the pipette upright and beginning with the 10^{-4} dilution one drop was allowed to fall from a height of 1 inch on to the surface of a blood-agar plate placed on a horizontal surface. The blood-agar plate was divided into six radial sectors and one drop was placed on each sector. One blood agar plate was used for each dilution. The plates were covered as soon as the six drops were placed. They were left for half an hour untouched to enable the surface drop to dry, and were then inverted and incubated for 24 hours.

Counts were then made of the colonies in each sector. The average count for the six sectors of each plate was taken as the viable count per 0·02 ml. in that dilution. When the drop of one sector merged with that of another sector the total count of the whole plate was taken as the viable count per 0·12 ml. in that dilution. Counts cannot be made in cases with confluent growths.

RESULTS

There were a total of 150 patients who were investigated. Of these 32 had viable bacterial counts of over 100,000 colonies per ml. in a freshly voided sample of urine.

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The type and frequency of occurrence of infective organisms in these 32 patients were as follows:

E.	coli	11	Gram negative organisms 30 (94%)
B.	alkaligenes	5	
B.	proteus	4	
Ps.	pyocyanea	3	
A.	aerogenes	7	
Staph.	albus	2	
	Total	32	

The symptoms which these 32 patients had were:

Increased frequency micturition	6
Dysuria	6
Loin ache	3
Fever	2
Foul urine	1
	18

Nineteen patients (59 per cent) did not have any symptom of urinary infection but all had proteinuria when the urine was routinely tested for it at the ante-natal clinic.

DISCUSSION

The method of quantitative bacterial culture was found to give good correlation between the clinical diagnosis of acute pyelonephritis and bacteriological identification of the infective organism. Moreover, even among the 32 patients with significant bacteriuria *i.e.* more than 10^5 organisms per ml. of urine, there were 19 (59 per cent) who had no symptoms but only proteinuria. About 6 per cent of all pregnant women have been found to have asymptomatic bacteriuria. Thus quantitative bacterial culture is useful for diagnosis of the disease in patients who may or may not have urinary symptoms.

In the method of collecting a urine specimen, a freshly voided mid-stream specimen of urine was collected into a wide-mouthed sterile container without prior cleaning of the vulva. Credit should go to Kass (1957) for his suggestion that "clean voiding specimens of urine" instead of the traditionally accepted catheterised specimens were satisfactory for the bacteriological investigation of urinary tract infection in the female patient. This is now accepted practice (Kass, 1960; Merritt and Sanford, 1958; Kincaird-Smith, 1965; and Little, 1966). This great advance in method of urological investigation in women patients decreases the grave and real risk of introducing pathogenic organisms into the lower urinary tract when catheterisation is employed (Brumfitt, et al. 1961).

Although there is general agreement to use a mid-stream specimen of urine in the female patient opinion is divided as to whether prior cleaning of the vulval area is necessary. Turner (1961) investigated this problem by performing quantitative bacterial cultures on one group of 200 female patients who had the vulval area swabbed with soap and water before collection of the urine sample and a second group for 200 women where this was not done. She found that there was no significant degree of contamination in the urine samples of the unswabbed group and concluded that prior swabbing of the vulval area was unnecessary. Kincaird-Smith (1965) obtained reliable results using the method that did not require prior swabbing of the vulva. Little (1966) however, performed prior cleaning of the vulva in his series of 5,000 patients because he had earlier found several equivocal bacterial counts in a group of 80 patients who did not have prior swabbing. He had to admit that "the most expensive and inconvenient part of the procedure is to collect a satisfactory urine sample". It is because the method of quantitative bacterial culture can differentiate between levels of significant bacteriuria (more than 100,000 organisms per ml. of urine) and contamination (less than 10,000 organisms per ml. of urine) that we feel we can employ a freshly voided mid-stream specimen of urine without prior vulval cleaning in the female patient.

There was 1 species of pathogenic organisms responsible for the urinary tract infection in each of these 32 patients. Thirty of them (94 per cent) were Gram negative organisms with E. coli being the most common (11 or 34 per cent). The preponderance of Gram negative organisms with E. coli being the most frequent infective organism is also the finding of other investigators (Turner, 1961; Brumfitt, et al 1961 and Patrick, 1966). This can be used to advantage in that the Triphenyl Tetrazolium Chloride test (Simmons and Williams, 1962) and the modified Nitrite Test (Sleigh, 1965) can be used as screening tests because these detect Gram negative bacteriuria with an accuracy of above 90 per cent. Actual bacterial counts can then be determined by the method described above or a simpler method using the blotting paper strip technique described by Brumfitt (Brumfitt, 1965).

SUMMARY AND CONCLUSION

Thirty-two out of a total of 150 patients suspected of having acute pyelonephritis were

found to have significant bacteriuria. E. coli was the most common infective organism and Gram negative organisms accounted for 94 per cent of the infections. A freshly voided mid-stream specimen of urine without prior vulval cleaning and cultured within 30 minutes of collection was employed. The method of quantitative bacterial culture described is a reliable method for proper bacteriological control in the management of patients with urinary tract infections. The method though a little laborious is practicable and can be performed in any bacteriological laboratory in this country.

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